College of Engineering

Georgia Institute of Technology

Atlanta, Georgia

NASA-GIT PREDOCTORAL DESIGN TRAINING PROGRAM

GRANT NOS. NGT 11-002-064 and NGR 11-002-081

P R O G R E S S R E P O R T

AUGUST 31, 1970 - AUGUST 31, 1971

October 1971

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I. SUMMARY

August 31, 1971 terminates the fourth year of the NASA Design Traineeship Program at Georgia Institute of Technology. A total of seven Trainees were supported directly by NGT 11-002-064. A total of thirteen current and former Trainees were enrolled in Georgia Tech's graduate school during the year and were assisted in their research efforts to varying degrees by NGR 11-002-081.

During the reporting period two Trainees left the program and graduate school after completing their MS degree work. A third student changed his status for financial reasons to that of Instructor in the School of Industrial and System Engineering.

Three new Trainees entered the progam (at advanced levels) in the Fall Quarter of 1970 and one in the Winter Quarter of 1971.

Of the thirteen current and former Trainees enrolled in graduate school during the year the five under the original grant and four under Supplement I have completed all academic requisites for the PhD except the thesis. Thesis work has proceeded at a disappointing rate.

A cooperative effort between Georgia Tech and Lockheed-Georgia Company has been worked out to develop a system of interactive graphics for computer-aided design. Lockheed-Georgia has one of the leading groups in the nation in the development of interactive graphics.

The graphics equipment at Lockheed with light pen is being connected to the Univac 1108 at Tech. Lockheed is providing their system time free to our Faculty and Trainees. Georgia Tech through NGR 11-002-081 is providing the actual labor and hook-up costs.

The final report on the student projects, Residential Solid Waste System, Collection and Disposal in Atlanta, was published and distributed. This resulted from the 1970 activities of the AE, EE, ME 655-56 class. The 1971 class studied the water pollution problems of the Atlanta area and a report is currently being edited. Several of the Supplement I and II Trainees are basing their thesis work on preliminary investigations conducted by these teams of graduate students.

A draft text entitled "Rational Planning: A System Approach" has been prepared by Steve Dickerson and Joe Robertshaw. Dr. Robertshaw, a former participant in the NASA-MSC-U of H Summer Faculty Fellowship Program in Systems Engineering, was a visiting professor at Georgia Tech during his subbatical leave from Providence College from September 1970 until September 1971.

This report has been prepared by Dr. Steve L. Dickerson, Project Coordinator with the assistance of Dr. Virgil Smith (A.E.) and Dr. Thomas White (E.E.) who are part of the principal staff carrying out the program and doing the teaching in it. Other faculty members who have been involved in the program are Professor Don W. Dutton (A.E.), Mr. Gary Draper (I.S.E.), and Dr. Joseph Talavage (I.S.E.).

II. TRAINEE STATUS AND PROGRAMS

Those current and former Trainees who have received graduate credit at Georgia Tech during the reporting period are as follows.

Name	Major	GPA	Course Work Completed	PhD Qualified Passed	Foreign Language Satisfied	MS Degree
Original						
Charles R. Andrews	EE	3.4	Yes	Yes	Yes	Yes
Lester D. Dozier	ME	3.1	Yes	Yes	Yes	Yes
Richard Hess	ME	3.6	Yes	Yes	Yes	Yes
Roscoe M. Hinson	ME	3.7	Yes	Yes	Yes	Yes
Harvey C. Taylor	ME	3.9	Yes	Yes	Yes	Yes
Supplement I						
William I. Crichton, Jr.	ISE	3.8	Yes	Yes	No	Yes
Robert S. Gordy	EE	3.7	Yes	Yes	Yes	Yes
William E. Pugh III	ME	3.6	Yes	Yes	Yes	Yes
George A. Townes	ME	3.2	Yes	Yes	Yes	Yes
Supplement II						
John H. Duchman	ISE	3.2	No	No	No	No
Carroll S. Kirkpatrick	ME	3.5	No	No	No	No
Francis W. Skwira	ME	3.5	No	Yes	No	Yes
Stephen L. Stumph	ISE	3.4	No	No	No	Yes

Mr. David E. Ferguson (ISE) and Mr. E. Kevin Dahill terminated their graduate work with the MS degree. They both left the program beginning September 1970. Mr. Carroll Kirkpatrick, Francis W. Skwira, Stephen Stumph, and George Townes were all added to the program in Fall 1970. Mr. John Duchman was added beginning Winter 1970.

The following pages give an itemized accounting of the academic record of those Trainees directly supported by NGT 11-002-064.

ROBERT STEPHEN GORDY

Courses Taken.		Grades	Quarter Hours
Fall 1970			
EE 800	Thesis		12
Winter 1971			
EE 800	Thesis		15
Spring 1971			
EE 800	Thesis		17
Summer 1971			
EE 800	Thesis		17

WILLIAM EDWARD PUGH, III

Courses Taken		Grades	Quarter Hours
Fall 1970			
EE 638	Random Processes	A	3
SyE 680	System Engr. Tech I	A	3
Math 415	Probability	V	3
ME 676	High Temp Design	A	3
ME 700	Thesis		2
Winter 1971			
MGT 620	Ind Organization	A	3
Math 420	Vector Analysis	A	3
ME 665	Mechan Synthesis	A	3
ME 677	High Temp Design	A	3
ME 700	Thesis		3
Spring 1971			
ME 678	High Temp Design	V	3
ME 700	Thesis		12
Summer 1971			
CE 438	EL Aerial Photog	V	3
ME 800	Thesis		13

GEORGE ANDERSON TOWNES III

Courses Taken			Grades	Quarter Hours
Fall 1970				
ME	654	Sys Design Method	V	3
ME	800	Thesis		12
Winter 1971				
ME	800	Thesis		12
Spring 1971				
EE	709	Special Topics	V	3
ME	800	Thesis		12
Summer 1971				
OCS	706	Special Problems	V	3
ME	800	Thesis		12

JOHN HUGHES DUCHMAN

Courses Taken		Grades	Quarter Hours
Fall 1970			
IE 705	Special Problems	W	3
IE 755	Indus Dynamics	B	3
Math 401	Analysis	C	3
Math 704	Special Topics	A	3
Winter 1971			
IE 671	Optimization	A	3
IE 700	Thesis		1
Math 402	Analysis	B	3
Math 418	Probability	B	3
ME 655	Interdisc Design	A	3
Spring 1971			
IE 690	Special Topics	A	3
Math 403	Analysis	C	3
Math 419	Probability	B	3
ME 656	Interdisc Design	A	3
Summer 1971			
ISYE 674	Dynamic Prog	W	3
ISYE 691	Special Topics	W	3
ISYE 700	Thesis		3
Math 405	Modern Algebra	W	3

CARROLL STONE KIRKPATRICK

Courses Taken			Grades	Quarter Hours
Fall 1970				
ME	445	Auto Control	V	3
ME	654	Sys Design Method	A	3
ME	671	Def of Metals I	A	3
ME	676	High Temp Design	A	3
ME	684	Feedback Systems	W	3
Winter 1971				
IE	425	Engr Economy	V	3
ME	655	Interdisc Design	A	3
ME	672	Fabrication Met	A	3
ME	700	Thesis		3
Psy	401	Indus Psychology	V	3
Spring 1971				
ME	656	Interdisc Design	A	3
ME	673	Fabrication Met	A	3
ME	700	Thesis		9
Summer 1971				
ME	700	Thesis		12

FRANCIS WILLIAM SKWIRA

Courses Taken		Grades	Quarter Hours
Fall 1970			
ME 622	Thermodynamics	V	3
ME 635	Heat Transfer	V	3
ME 643	Sys Design Method	A	3
ME 740	Fluid Mech Sem	W	1
Winter 1971			
ME 623	Thermodynamics	W	3
ME 644	Fluid Flow	B	3
ME 645	Heat Transfer	B	3
ME 655	Interdisc Design	B	3
ME 677	High Temp Design	A	3
ME 739	Heat Transfer	V	1
Spring 1971			
ME 646	Heat Transfer	B	3
ME 699	PhD Qual Exam	V	4
ME 707	Special Topics	V	5
ME 741	Two Phase Flow I	A	3
Summer 1971			
Fren 001	French for Grads	V	
ME 699	PhD Qual Exam	V	6
ME 800	Thesis		1

STEPHEN LYNN STUMPH

Courses Taken		Grades	Quarter Hours
Fall 1970			
IE 649	Design Indus Exp	W	3
IE 700	Thesis		2
IE 755	Indus Dynamics	B	3
SyE 680	Sys Engr Tech I	C	3
ME 654	Sys Design Method	A	3
Winter 1971			
IE 460	Mgt Systems Dsgn	V	3
IE 601	Mod Indus Organ	A	3
IE 700	Thesis		1
Math 443	Numerical Analy	W	3
ME 445	Auto Control	D	3
ME 655	Interdisc Design	A	3
ME 687	Control Systems	B	3
Spring 1971			
IE 602	Proj Sel Meth	A	3
IE 672	Optimization	W	3
IS 632	Info Syst Equip	A	3
ME 656	Interdisc Design	A	3
ME 688	Control Systems	A	4
Summer 1971			
ISYE 700	Thesis		13

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF THE REGISTRAR
REGISTRATION AND RECORDS

October 20, 1971

III. CERTIFICATION OF FULL-TIME STATUS

This is to certify that the students listed below registered for full-time graduate status at the Institute during the periods indicated:

John Hughes Duchman	Fall 1970 thru Spring 1971
Robert Stephen Gordy	Fall 1970 thru Summer 1971
Carroll Stone Kirkpatrick	Fall 1970 thru Summer 1971
William Edward Pugh, III	Fall 1970 thru Summer 1971
Francis William Skwira	Fall 1970 thru Summer 1971
Stephen Lynn Stumph	Fall 1970 thru Summer, 1971
George Anderson Townes	Fall 1970 thru Summer 1971

A full-time graduate student at the Institute must register for at least 12 quarter hours of work including hours of research and auditing.

Certified by

A.L. Bostock, Jr.
Director

ALB:k

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

DIVISION OF GRADUATE STUDIES AND RESEARCH
OFFICE OF THE DEAN

21 October 1971

Dr. S. L. Dickerson
School of Mechanical Engineering
Campus

Dear Dr. Dickerson:

This letter is to clarify further the situation of Mr. John H. Duchman. He was enrolled for the summer quarter but because of a severe personal problem dropped out of school for the last eight days of the quarter. This action was discussed in detail in the Graduate Office and it was an appropriate action for him to take.

Sincerely,

Sam C. Webb

Sam C. Webb, Dean

SCW:hb

IV. PROJECTS

The project chosen each year is the basis of the two quarter Complex Systems Design Course Sequence and the Ph.D. dissertations of the Trainees. The Trainees dissertations are intended to carry into greater depth some of the more critical problem areas encountered in the preliminary study.

Solid Waste Collection and Disposal

In January 1970, the Complex System Design Class undertook a study of Atlanta Regional waste collection and disposal. A total of twelve graduate students were involved - four from City Planning-Civil Engineering; three from Mechanical Engineering; three from Electrical Engineering; and one each from Industrial and Systems Engineering and from Biology.

The study resulted in a number of recommendations for development and implementation. For example, the study indicated that the Atlanta region should move toward (1) highly automated residential trash and garbage collection, (2) more extensive use of high quality landfill to increase the utility of land and (3) separation of solid wastes to provide for partial recycling. An oral report was given in early June and a written report has been published and distributed to Atlanta area planners.

Water Pollution Control

The theme of the 1971 project was water pollution in the Atlanta area. This continued the emphasis on environmental control. The team of fourteen students emphasized the modelling of waste generation, water treatment and river quality. A report is currently being edited.

The project was conducted in close cooperation with MacHealth, the Metropolitan Atlanta Council for Health which is the organization directly responsible for comprehensive area wide health planning, as well as the Atlanta water pollution control officials.

Urban Transportation

Current plans call for the 1972 study to emphasize urban transportation developments in Atlanta. The exact emphasis will depend on the outcome of the rapid transit referendum in November. If the referendum passes the study will concern highway system improvements and best utilization of the mass transportation system. If it fails the mass transportation problem itself will be addressed.

V. OTHER ACTIVITIES

Dr. Joe Robertshaw, a participant in the NASA - University of Houston-MSC, Summer Faculty Systems Design program, was on the staff of the School of Mechanical Engineering as a Visiting Associate Professor for the 1970-71 calendar year. Dr. Robertshaw was on sabbatical leave from Providence College, Rhode Island, and collaborated with Dr. Dickerson in preparing a text on the systems approach to design.

The text is currently being used in the course AE, EE, ME 654, Systems Design Methodology. With the completion of additions and modifications during the 1971-72 year it is hoped to publish it for general sale. Ten copies have been sent to NASA for review and comment.

An agreement for cooperative development of an interactive computer graphics system has been executed with Lockheed-Georgia Company. This system will be used to support the dissertation work of NASA Design Trainees as well as to demonstrate the feasability and utility of such a system to the campus community. A copy of the agreement is attached as an Appendix.

Dr. Dickerson and Dr. C. J. Huang of the University of Houston presented two papers at the XXI st International Astronautics Congress in October of 1970. They were entitled "Concepts and Systems Design of Space Emergency Re-entry Vehicle" and "Concepts and Systems Design of Satellite Servicing Vehicles." Two copies of each are mailed with this report.

Appendix COMPUTER GRAPHICS SERVICES AGREEMENT

THIS AGREEMENT made and entered into in duplicate as of the 23rd day of May , 1971, by and between the LOCKHEED-GEORGIA COMPANY, Marietta, Georgia (hereinafter referred to as "Gelac"), a Division of Lockheed Aircraft Corporation, and GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, Georgia (hereinafter referred to as "GIT").

1. SERVICES FURNISHED:

Gelac agrees to furnish the following services to GIT:

1.1 Instructor Training - Subject to the man-hour, billing code, and rate limitations of Paragraph 3 below, Gelac shall train two (2) GIT staff members, who shall be familiar with conventional Fortran programming, in the use of a simple computer graphics programming language to be selected by Gelac. This training shall be adequate to qualify the two GIT staff members to instruct qualified graduate students in the use of such graphics programming language for simple programs.

1.2 Interconnection of Systems - Gelac shall provide the necessary interfaces, including a MAC-16 interface, LEC 20-245 or equivalent, for connecting the MAC-16/IDI graphics system at Gelac to the Univac 1108 at GIT through conventional dial-up services. This interconnection will be suitable for (a) demonstrating the practicability of remote graphics and (b) timing and computer analysis. Maximum use shall be made of existing GIT equipment and Univac 1108 software.

1.3 Demonstration and Technical Discussion - Gelac shall arrange and carry out a demonstration and technical discussion of its low-cost computer graphics software system for attendance by computer personnel of GIT,

Univac and Gelac. This demonstration and technical discussion is intended to inform the attendees of the operational aspects of the Gelac low-cost computer graphics system, including Gelac's experience with the 1557/1558.

1.4 Gelac shall make its low-cost graphics system available to GIT personnel at times mutually convenient to Gelac and GIT during the period of this agreement.

2. LOCATION OF WORK:

The Training and the Demonstration and Technical Discussion according to Paragraph 1 shall be provided at the Gelac Research Laboratory. The Univac 1108 interconnection effort shall be carried out at Gelac and GIT as required.

3. CONSIDERATION:

3.1 In consideration of services furnished by Gelac under this Agreement, GIT shall pay to Gelac amounts as invoiced according to the following schedule:

Item	Manhours	Billing Code	Rate	Total
Instructor Training	60	513	$10.11	$ 606.60
Interconnection of MAC-16/ IDI and U1108				
Software	116	513	$10.11	$1172.76
Design	60	514	$10.65	$ 639.00
Installation	40	710	$ 6.60	$ 264.00
Applications	80	513	$10.11	$ 808.80
Demonstration/Technical Discussion		None		
				$3491.16

3.2 GIT shall also pay Gelac one (1) man-hour of Gelac personnel time at an average rate not to exceed Ten Dollars Fifty Cents ($10.50) per hour for each hour of graphics system time supplied by Gelac according to Paragraph 1.4.

3.3 GIT shall also pay Gelac an amount not to exceed Three Hundred Dollars ($300.00) for rental of the MAC-16 Interface provided according to Paragraph 1.2 above.

3.4 GIT shall lease at its expense a dial-up line (2,000 Baud) and two terminals (201A) from the Southern Bell Telephone Company.

4. RIGHTS IN DATA:

4.1 The Gelac low-cost graphics software system known as FLING shall be made available by Gelac for use of GIT personnel during the period of this agreement; however, GIT shall obtain no right to use the FLING system after the termination of this agreement, and GIT shall not disclose or otherwise make available the FLING system to others at any time without first obtaining the written permission of Gelac.

4.2 All graphics software developed by GIT during the period of this agreement shall be made available for use by Gelac; however, Gelac agrees not to disclose such software outside of the Lockheed Aircraft Corporation without first obtaining the written permission of GIT.

4.3 Nothing in this Agreement shall preclude GIT from independently developing a computer graphics system of its own, or from obtaining and using a computer graphics system which is in the public domain or which is available from another source.

5. FUTURE USE OF GELAC GRAPHICS SOFTWARE:

If GIT decides to develop an on-campus computer graphics facility similar to the Gelac low-cost graphics software system, then Gelac agrees to offer to GIT a nonexclusive, nontransferable license to use the Gelac-developed low-cost graphics software system for a fee and under other terms and conditions mutually acceptable to Gelac and GIT and approved by the State Budget Bureau of Georgia.

6. PERIOD OF THE AGREEMENT:

The period of this Agreement extends from the date the Agreement was entered into, as given above, to May 23, 1972.

7. TERMINATION:

This Agreement may be terminated by either party by giving the other party fifteen (15) days' written notice of its intention to do so. Such termination shall not affect the liability of either party to the other for payment of services actually rendered under this Agreement prior to the date of termination.

8. UNDERSTANDING:

This written instrument constitutes the entire agreement between the parties and shall not be varied, amended, or supplemented except by a writing of subsequent or even date executed by both parties.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in duplicate on the day and year first written above.

LOCKHEED-GEORGIA COMPANY

By W. S. Hilburn
Name: W. S. Hilburn
Title: Attorney-in-Fact

GEORGIA INSTITUTE OF TECHNOLOGY

By Frank A. Sloan
Name:
Title:

APPROVED:
Gary C. Monroe
FOR SUPERVISOR OE PURCHASES
5-28-71